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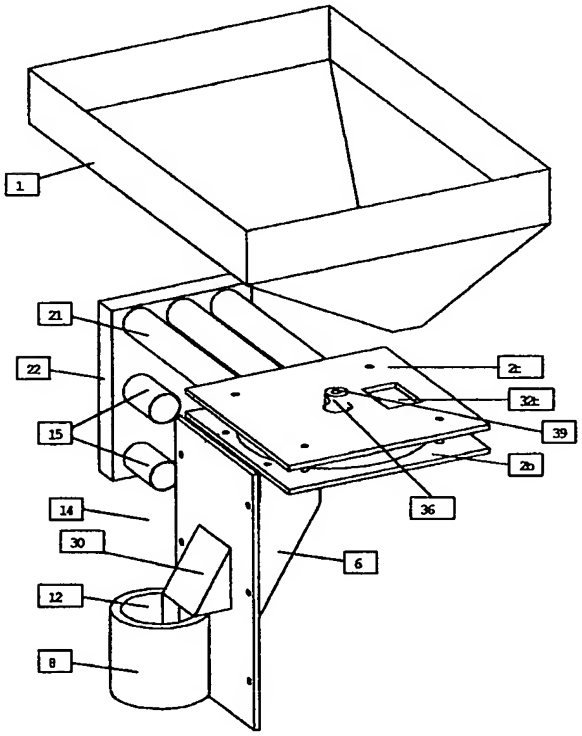
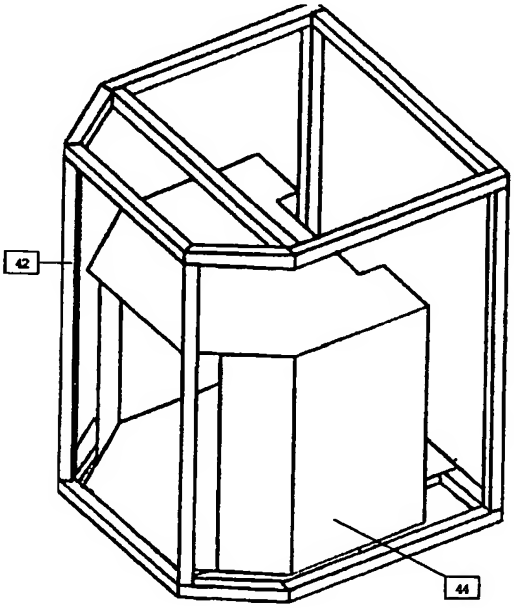
(54) Titre : APPAREIL DE CHAUFFAGE A BIOMASSE
(54) Title: BIOMASS FUEL HEATING APPARATUS





(57) Abrégé/Abstract:
The Heating Apparatus uses pelletized wood waste material as a Biomass fuel. A hopper feed system controlled by a 180° timed round rotating disk, which drops the pellets into a slide shaft and burn pot. An outside mounted air exchanger has a exhaust pipe mounted within a larger air intake pipe powered by an electric motor. Extrudes hot exhaust and at the same time draws fresh air into the apparatus for distribution of hot air into the desire facility. The apparatus is free standing and may used as a fireplace insert. The exterior will maintain room temperature while the firebox may extrude 40,000 BTU. Fabricated with steel the life expectancy is unlimited. The augerless feed and fresh air eliminates a chimney and has a "0" heat tolerance for safety. The apparatus will burn any combustible fuel pellets produced from various waste materials with significant reduction in pollutant emissions.

020

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May 15, 2002

Ms. Donna Daily
Commissioner Of patents
Ottawa-Hull K1A 0C9

Dear Ms. Donna Daily:

Re: Patent Application No. 2,358,404 – Filing date 2001/09/20

Thank you for your telephone call Tuesday, May 14, 2002 advising that we had not submitted an abstract for the "Biomass Fuel Heating Apparatus".

The PelletStar 2002

The Heating Apparatus uses pelletized wood waste material as a Biomass fuel. A hopper feed system controlled by a 180° timed round rotating disk, which drops the pellets into a slide shaft and burn pot. An outside mounted air exchanger has a exhaust pipe mounted within a larger air intake pipe powered by an electric motor. Extrudes hot exhaust and at the same time draws fresh air into the apparatus for distribution of hot air into the desire facility.

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Sincerely,

Herbert L. Tobias

Title: PelletStar ☆ 2000

BIOMASS FUEL HEATING APPARATUS

1. **Background of the Invention**

The present invention relates to a heating apparatus that is designed to transfer and burn biomass fuel safely and efficiently. Particularly to recycle combustible waste material for Biomass Heating Fuel.

2. **Description of the Prior Art**

There are numerous pellet burning heating appliances on the market in North America. Manufacturers in Victoria, BC, Nanaimo, BC, Seattle, WA, Grass Valley, CA provide products and are available to consumers.
Patent registered on these products and some with patents pending all offers primarily similar features with varied cosmetic design.
Most all pellet heating appliances offer heating capacity of 700 to 2000 square feet, weight up to 250 pounds, cast iron burn systems, cool stove exterior, pellet storage of 40 to 120 pounds and the necessary EPA, ULC and CSA approvals. All known pellet stoves are available black in colour with more expensive models having chrome or brass trim as a cosmetic attraction.
All known pellet stoves have either a bottom or top auger feed system and utilizes room air to recycle for extrusion of hot air.
Exhaust systems consist of the common type system designed for natural gas heating appliances.
Installation in most cases is simple with an instruction sheet for owner's installation; however, building inspection and permits are a requirement.
Three major objections identified by customers using pellet stoves are:

a. Safety factors of an auger halted owing to power failure may result in "burn-back" to hopper.
b. Usage of existing room oxygen to recycle air for heat ventilation.
c. Cosmetic appearance to meet room furnishings and decorative design.

3. **Summary of Invention**

Recognizing these disadvantages with prior art forms of equipment, it is, therefore, a first object of the present invention to overcome such disadvantages and to provide a new and improved pellet heating apparatus, which is well – engineered.

Another objective of the present invention is to provide a pellet heating apparatus, which is efficient functionally, enironmentally friendly and safe to use.

Design the exhaust ventilation system to exhaust the hot gases through a one and a half inch pipe and draw outside fresh air through the three inch pipe encompassing the hot gas vent into the burning chamber eliminating the use of

present room oxygen and at the same time warming the fresh air being drawn back to the appliance

Design a fuel feed system that efficient and eliminate the danger of any burn back or plugging .

Last but not least is the cosmetic value of having the benefit of a wide range of exterior colour panels or a choice of exterior wood finishes to enhance furniture or decorative interior designs.

The forgoing objects are attained by providing a pellet heating apparatus that offers a problem free solid fuel system (41 Fig. 1) especially designed to transfer, and burn bio energy fuel more particularly wood pellets and most other pelletable waste material. This device tremendously widens the useable range of solid fuel burning in a more problem free manor.

4. **Brief Description of the Drawings**

although the characteristics features of this invention will be particularly detailed in the claims, the invention itself and the manner in which it may be made and used, may be better understood by referring to the following description, taken in connection with the accompanying drawings forming part thereof, wherein like reference numerals refer to like parts throughout several views, in which;

Fig. 1. is a schematic front view of the pellet stove apparatus including all components
Fig. 2. is a schematic front view of the pellet stove apparatus
Fig. 3 is a back view of the fuel disc, fan and power assembly.
Fig, 4 is a schematic front view of stove frame assembly
Fig. 5. Front view of complete stove
Fig. 6 Is a schematic view of exhaust system

The embodiment of the invention in which an exclusive property of privilege is claimed are defined as follows:

Pellet burning apparatus comprising of the following components that when assembled in accordance with engineered and designed production plans create the pellet burning apparatus as formerly described.

PELLET STOVE PARTS LIST

1.) Hopper or Fuel Storage
2t.) Upper Disc Holding Plates
2b.) Lower Disc Holding Plates
3.) Fuel Disc
4.) Fuel Metering Compartments
5.) Electric Motor
6.) Power Slide.

8.) Combustion Firer
12.) Air/ Gas/ Flame/ Deterrent Section
13.) Combustion Exit Holes
14.) Heat Exchanger
15.) Exhaust Holes or Ports
16.) Exhaust Motor
17.) Viewing Maintenance Door
19.) Viewing Glass
20.) Control Circuitry Panel
21.) Exhaust Tubes
22.) Cooling Chamber
27.) Fuel Hopper Lid
28.) Expanded Metal Shroud
29.) Control Panel Lid
30.) Pellet Air Director
31.) Fuel Disc Holder Spacer
32t.) Hole in. Upper Fuel Disc Holders
32b.) Hole in. Lower Fuel Disc Holders
34.) Hopper Exit Hole
35.) Power Slide Entrance Point
36.) Power Shaft of Electric Motor or Power Source
38.) Air Fuel Mixing Chamber
39.) Disc Holding Plate Center Hole
40.) Cooling Fan & Motor
41.) Fuel System
42.) Mounting Plate
43.) Exhaust Shroud
44.) Inside Heat Shroud
45.) Inner Exhaust Flow Tube
46.) Metal Side Panels
47.) Exhaust Encasement (exterior)

Various modifications can be made without departing from the scope of the spirit of the invention, or the scope of the appended claims. The embodiments set forth in this disclosure are given as examples and are in no way final or binding. In view of the above, it will be seen that the objects of the invention are achieved and other advantages are obtained. As many changes could be made in the above pellet heating apparatus without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrated and not in a limited sense.

5. Description of the Preferred Embodiment

A problem free solid fuel system (41, Fig. 1) especially designed to transfer, and burn bio energy fuel more particularly wood pellets and most other pelletable waste material. This device tremendously widens the useable range of solid fuel burning in a more problem free manor.

A fuel storage area or hopper (1, Fig. 1 & 2) hold solid fuel of varied sizes from dust up to larger pellet fuel of approximately 1" cubes. These sizes can be larger if burning system is built larger with greater capacities. The fuel hopper (1, Fig.1 & 2), (constructed of metal, fibre glass, or almost any other material),is attached to the upper disc holding plate (2t, Fig.1 & 2). The upper disc holding plate (2t, Fig.1 & 2), is constructed of metal, cast iron of almost any other long wareable material and it holds the fuel hopper (1, Fig.1 & 2) in its place above the disc holding plate (2t, Fig.1 & 2). This is done by bolts, screws or any device that binds the two pieces (1, Fig.1 & 2) and (2t, Fig.1 & 2) together.

The solid fuel of varying sizes free falls or drops by gravity Out of the hopper, (1, Fig.1 & 2). The hopper which maybe round, square, oblong, rectangular or almost any other dimension as long as it is large enough to hold a capacity of fuel. The fuel falls through hole (34, Fig.1) in the bottom of the hopper (1, Fig.1 & 2). The hole must be large enough) for the solid fuel to pass through, generally 1 1/2" square or larger hole in diameter.

Just below the upper, disc holding plate (2t, Fig.1 & 2) is fuel disc (3, Fig.1). Below the fuel disc (3, Fig.1) is another disc holding plate (2b, Fig.1 & 2), or the lower, fuel disc holding plate (2b, Fig.1 & 2). The two fuel disc holding plates (2t, Fig.1 & 2) and (2b, Fig.1 & 2) are interchangeable, both being the same dimensions. Disc holding plate (2t, Fig.1 & 2) is used for the top or upper position and (2b, Fig.1 & 2) is used to the bottom or lower position. Plate (2t, Fig.1) being above the fuel disc (3, Fig.1) and (2b, Fig.1 & 2) being below the fuel disc (3, Fig.1). The upper plate (2t, Fig.1 & 2) attaches to the hopper (1, Fig.1 & 2) and (2b, Fig.1 & 2) attaches to the air fuel mixing chamber (38, Fig.1). The fuel disc plates (2t, Fig.1 & 2) and (2b, Fig.1 & 2) are attached together by bolts or screws on the outer portions of the fuel disc holding plates (2, Fig.1 & 2t) and (2b, Fig.1 & 2). These locations are called connection locations. Fuel disc holder spacer's (31, Fig.1) are placed around connecting bolts or screws at each connection location. This allows proper distance or space to lay between each fuel disc holder (2t, Fig.1 & 2) and (2b, Fig.1 & 2). The reason for the proper space or distance between (2t, Fig.1 & 2) and (2b, Fig.1 & 2) is that the fuel disc (3, Fig.1) can be positioned between (2t, Fig.1 & 2) and (2b, Fig.1 & 2), then rotates freely between the two plates by a motor(5, Fig. 3).

The fuel disc (3, Fig.1) is circular in appearance and has one or more holes or metering compartments (4, Fig.1) placed in its body. The fuel metering compartments (4, Fig.1) consist of a hole or port drilled, molded, or placed completely through the disc. The disc is made of metal, cast iron, or any other substance which will wear we'll under heavy use. The holes or compartments (4, Fig.1) are placed a distance from the center of the fuel disc (3, Fig.1). That distance is the same distance as the hopper exit hole (34, Fig.1) is from the power source or electric motor's drive cower shaft (36, Fig.1, 2 & 3). The drive power shaft (36, Fig.1, 2 & 3) is part of the power source or electric motor (5, Fig. 3), which turns or rotates the fuel disc (3, Fig.1). A setscrew, bolt or other device is used

to attach the power shaft (36, Fig.1, 2) of the electric motor (5, Fig. 3) to the fuel disc (3, Fig.1). The power source is mounted or attached to the lower side of the lower fuel disc holder (2b, Fig.1 & 2). The motor (5, Fig. 3) with its drive power shaft (36, Fig.1 & 2) reaching through a hole (39, Fig. 2) in the center of holding plate (2b, Fig.1 & 2) attaches to the fuel disc (3, Fig.1) at its center and spins or rotates the disc (3, Fig.1) periodically.

All fuel falls from the hopper (1, Fig.1 & 2) onto the fuel metering compartment ring through holes (32t, Fig.1 & 2) and (32b, Fig.1) which lay together,(34, Fig.1) lying directly above (32t, Fig.1 & 2). As the motor (5, Fig.3) turns the fuel disc (3, Fig.1), the fuel slides along the moving disc ring (3, Fig.1) until a fuel metering compartment (4, Fig.1) passes under the pellets or fuel. As the compartments passes beneath the hopper opening (34, Fig. 1), the fuel falls by gravity into the compartments or holes filling each compartment with fuel. Since the metering fuel compartments (4, Fig.1) extend through the fuel disc (3, Fig.1) as a hole, the pellets which fall into the compartments (4, Fig.1) fall onto the lower fuel disc holding plate (2b, Fig.1 & 2). This holding plate (2b, Fig.1 & 2) acts as the bottom of the compartments (4, Fig.1) and as the disc turns the fuel is transferred in a circle from entrance at hole (32t, Fig.1 & 2) to exit at hole (32b, Fig.1). Lower holding plate (32b, Fig.1) acts the same as upper fuel disc holding plate (32t. Fig.1 & 2), it acts as a pellet and dust catcher and lies in a circle. The pellets within the compartment (4, Fig.1) slide along the lower holding plate (32b, Fig.1) until they come to the exit hole (32b, Fig.1). This hole is the same distance away from the center of the fuel disc (3, Fig.1) as the intake hole (32t, Fig.1 & 2) is from the center of the fuel disc (3, Fig.1). Its also a circle. As the compartments (4, Fig.1) filled with fuel move over the exit hole (32b, Fig.1) the fuel the with in the compartments (4, Fig.1) drops by gravity into the air fuel mixing chamber (38, Fig.1).

This system transferring of fuel pellets greatly improves the simplicity of the movement of the fuel and the extended life of the equipment used to transfer the fuel over old existing methods such as auger transferring of fuel pellets.

In most pellet or bio energy stoves the weight of the pellets setting on an open auger puts stress and turning friction on the auger. This is turn effects the electric motor power which drive the auger of most pellet burning stoves and burning devices.

This new transfer device called the fuel disc (3, Fig.1) does away with the problem. The hopper setting on top of the upper fuel disc holders (2t, Fig.1 & 2) transfers any pellet weight onto the holder (2t, Fig.1 & 2). In addition no pellet weight or weight, stress is transferred from the pellets to the power source or electric motor (5, Fig.3). This is because a hole in the hopper (34, Fig.1) allows pellets to flow out of the hopper (1, Fig.1) without transferring weight stress to the motor (5, Fig.3). Pellets flow out of the hopper but the base of the hopper and the holding plate (2t, Fig.1 & 2) supports all of the remaining weight except that which is in the fuel compartments (4, Fig.1) of the fuel disc (3, Fig.1). Thus the weight stress remains inside the hopper (1, Fig.1 & 2) reducing problems with the transfer motor (5, Fig.3) and greatly extending the motors (5, Fig.3) working life. Weight stress problem in the industry Negative Pellet Weight Stress or N.P.W.S. Less N.P.W.S. greatly improves file operation of a motor, because less weight load, improves efficiency. The motor is less likely to stall or quit and its less likely to break or wear out a gear. Both of these occurrences often happen in feed system and truly plagued the bio fuel, pellet fuel industry. The transfer system has no auger yet transfers fuel with precise measured amounts and increases safety in addition.

The air fuel mixing chamber (38, Fig.1) has an open top which allows fuel to drop into it's interior by gravity. This open top is called the power slide entrance point (35, Fig.1) and bolts or screws attach the air fuel mixing chamber (38, Fig.1) to the lower fuel disc holding plate (2b, Fig.1 & 2). The bottom of the chamber (38, Fig.1) is also open and connects on an angle to the power slide (6, Fig.1 & 2). The reason for the angle type connection is to allow distance to occur between the pellet source and fire burning area. This distance allows greater safety along with other advantages which will be discussed later in the description.

Returning to the air fuel mixing chamber (38, Fig.1) that the top and bottom walls are open. An opening in the lower portion of the slide tube (6, Fig.1 & 2) called the air intake adaptor, attaches to this open side wall by screws, bolts, or welding. The air intake adaptor (6, Fig.1 & 2) is the source of air intake from the outside of the unit into its interior. The air fuel mixing chamber (6, Fig.1 & 2) is the point where fuel and air first meet within the burning device. Three more walls need to be addressed as to their status in the mixing chamber (38, Fig.1). Those three walls are all closed. Thus three walls are open and three walls are closed in the mixing chamber (6, Fig.1 & 2) which is rectangular in shape and made of metal or cast iron. At the top end of the open wall air entrance into the air mixing chamber (38, Fig.1) a pellet/air director (30, Fig.1 & 2) is place. This pellet/air director (30, Fig.1 & 2) is bolted, molded, or welded onto the air intake adaptor (6, Fig.1 & 2) and protrudes or extends into the air fuel mixing chamber (38, Fig.1). This pellet/air director, (30, Fig.1 & 2) diverts air and pellets downward. It also keeps pellets from falling into the air intake adaptor, (6, Fig.1 & 2) from the power slide entrance point (35, Fig.1). The director (30, Fig.1 & 2) therefore directs both air and pellets downward into the power slide (6, Fig.1 & 2) from the air-mixing chamber where the air and fuel have started mixing.

It should be noted that most under auger and over auger pellet fuel feed systems mix the air and pellets at the point of combustion. This new air/fuel mixing chamber (6, Fig.1 & 2) starts air/fuel mixing earlier in the process well before combustion takes place. This early mixing results in greater and better air/fuel mixtures being achieved prior to combustion. Consequently this achieves better emission ratings and more even combustion over the present auger feed system.

The power slide (6, Fig.1 & 2) consists of four closed walls in the shape of a rectangle and two open walls. The open walls being lower end walls. The power slide sets in a downward angle starting with its connection to the air/fuel mixing (38, Fig.1) on the upper or top end. The lower open end of the power slide is attached to the combustion firer (8, Fig.1 & 2). The reason the power slide is called "power slide" is because:

A.) The fuel or pellets drop by gravity into the power slide and move towards the combustion chamber or fire box.

B.) Air being injected into the burning system at the air fuel mixing chamber (38, Fig.1) continues moving towards the combustion firer (8, Fig.1). This air movement helps to force the fuel or pellets in a cower slide effect.

C.) Small particles such as fuel dust or, saw dust which normally settles along auger type systems clogging or causing, weight stress on the system is caught by the moving air and power slid into the burning device (combustion firer 8. Fig.1 & 2) where it is consumed. This eliminates dust build up and potential dust related problems as is common in conventional auger feed systems.

The combustion chamber, (8, Fig.1 & 2) is a open combustion chamber, circular in appearance. A controlled burn occurs with the combustion chamber of the combustion firer (8, Fig.1 & 2). As the combustion firer, (8, Fig.1 & 2) increases in temperature pellets injected or power slide into the firer (8 Fig.1 & 2) ignites and explodes into combustion instantly. Air/fuel mixing beginning at the air fuel mixing chamber (38, Fig.1) and continuing through the power- slide (6, Fig.1 & 2) into the combustion firer (8, Fig.1 & 2) provide excellent air/fuel mixing. A tremendous amount of turbulence occurs in the combustion firer (8, Fig.1 & 2). This is caused by moving pellets entering the combustion firer along with large amounts of air entering the chamber. The air hits the circular walls of the combustion firer chamber (8, Fig.1 & 2) causing a swirling turbulence effect to occur. Combustion occurs through out the combustion firer chamber(8, Fig.1 & 2) as burning fuel, exploding gases, and the highly heated walls of the combustion firer chamber (8, Fig.1 & 2) cause excellent chamber combustion of fuel.

Remaining ash, flames , and hot air with greater emission statistics escapes through combustion (12, Fig.1 & 2) upper portion of the combustion firer chamber (8, Fig.1 & 2) . A small heat exchanger (14, Fig.1) surrounds the combustion firer (8, Fig.1 & 2). The firer (8, Fig.1 & 2) is close enough to the interior walls of the exchanger that the escaping flames from the firer (8, Fig.1 & 2) touch the exchanger walls. This causes excellent heat transfer from pellet BTU.'s to measurable heat output.

Burnt ash which is ejected through the combustion ports (12, Fig.1 & 2) and projects onto the exchanger walls with the escaping flames. The highly heated dry ash clings to the walls at the flame impact area. This ash coats the walls with a light approximately 1/4" protection shield of extremely hot burnt ash. The area covered being the same dimensions as the flame coverage. The approximate ¼" ash build up sets as a flame insulation, protecting the walls of the exchanger so excess heat doesn't break down or flake metal from the open flame hitting its surface. All other ash escaping from the firer will fall to the base of the exchanger where an ash pan is situated. This pan is called the ash removal pan.

The exchanger ports (15, Fig.1 & 2). These exhaust holes or ports (15, Fig.1 & 2) allows exhaust paths for any unburnt gases or exhausts that may still be present in the burning system. This exhaust exits the exhaust tubes (21, Fig.1, 2 & 3) into cooling chambers (22, Fig.1, 2 & 3) mounted on each side of the heat exchanger (14, Fig.1).

Great amounts of heat are achieved within the heat exchanger (14, Fig.1). The air passing through the slide tube (6, Fig.1 & 2) into the combustion firer (8, Fig.1 & 2) mixed with the fuel and combusted. The remaining combusted air is very hot so as it passes into the cooling chamber (22, Fig.1, 2 & 3) it fills the rectangular shape metal coolers and slows its exit departure. The hot air heats the heat exchanger, (14, Fig.1), exhaust tubes (21, Fig.1, 2 & 3) into the combustion firer (8, Fig.1 & 2) mixed with the fuel and combusted. The remaining combusted air is very hot so as it passes into the cooling chamber (22, Fig.1, 2 & 3), and the cooling chambers (22, Fig.1, 2 & 3). A cooling fan and motor (40, Fig. 3) sits behind the heat exchanger (14, Fig.2) and blows cool air across the heat exchanger (14, Fig.2), exhaust tubes (21, Fig.1, 2 & 3), and cooling chambers (22, Fig.1, 2 & 3). The blowing air transfers the heat from the heat exchanger (14, Fig. 2), exhaust tubes (21, Fig.1, 2 & 3), and cooling chambers (22, Fig.1, 2 & 3) off of the hot metal into the room or area to be treated.

All the above mentioned devices in Fig. 1, 2 & 3 bolt together with heat sealant or are permanently welded to form a complete fire box and heat exchanger (Fig. 2 & 3). This assembly Fig. 2 & 3 is then bolted into the frame assembly (42, Fig, 4) inside heat shroud (44, Fig. 4). The heat exchanger and fire box (Fig. 2 & 3) are firmly bolted in place. The frame (42, Fig. 4) is made of one inch square tubing welded together . There is an air

tight door (17, Fig. 5) fitted with a viewing glass (19, Fig. 5). This completes the fire box (Fig. 2 & 3).

The outside of the stove is fitted with metal panels (46, Fig. 5). These panels come in a choice variety of colours, The stove is designed and engineered for a zero tolerance of exterior heat conducted at the surface on the outer shell or panel thus allowing use of a wood finish shell rather than metal panels at customer request. The stove is also fitted with two lids (27 & 29, Fig. 5). Lid 27 (Fig. 5) covers and gives access to the pellet hopper (1, Fig. 1 & 2). Lid 29 (Fig. 5) covers and gives access to the control panel (20, Fig. 5). Between the stove frame (42, Fig. 4 & 5) and the fire box door (19, Fig 5) there is an expanded metal shroud (28, Fig 5) which allows heat to flow out of the front of the stove (Fig. 5).

The exhaust system (Fig. 6) is comprised of an exhaust motor (16, Fig. 6) which is mounted on mounting plate (42, Fig. 6). The exhaust is sucked out of the inner flow tube (45, Fig. 6) by the exhaust motor (16, Fig. 6) and discharged into the air when sucking exhaust out fresh air is forced into the firebox through the exhaust encasement tube (47, Fig 6) creating a negative draft in the firebox. The exhaust fan and mounting plate (16 & 42, Fig. 6) are covered by the exhaust shroud (43, Fig. 6).

Claims:

1. Rotary disk feed system.
2. Negative draft twin wall fresh air exhaust system.
3. Multi-colour exterior panel system.
4. Zero clearance stove exterior for the use of wood finishes.

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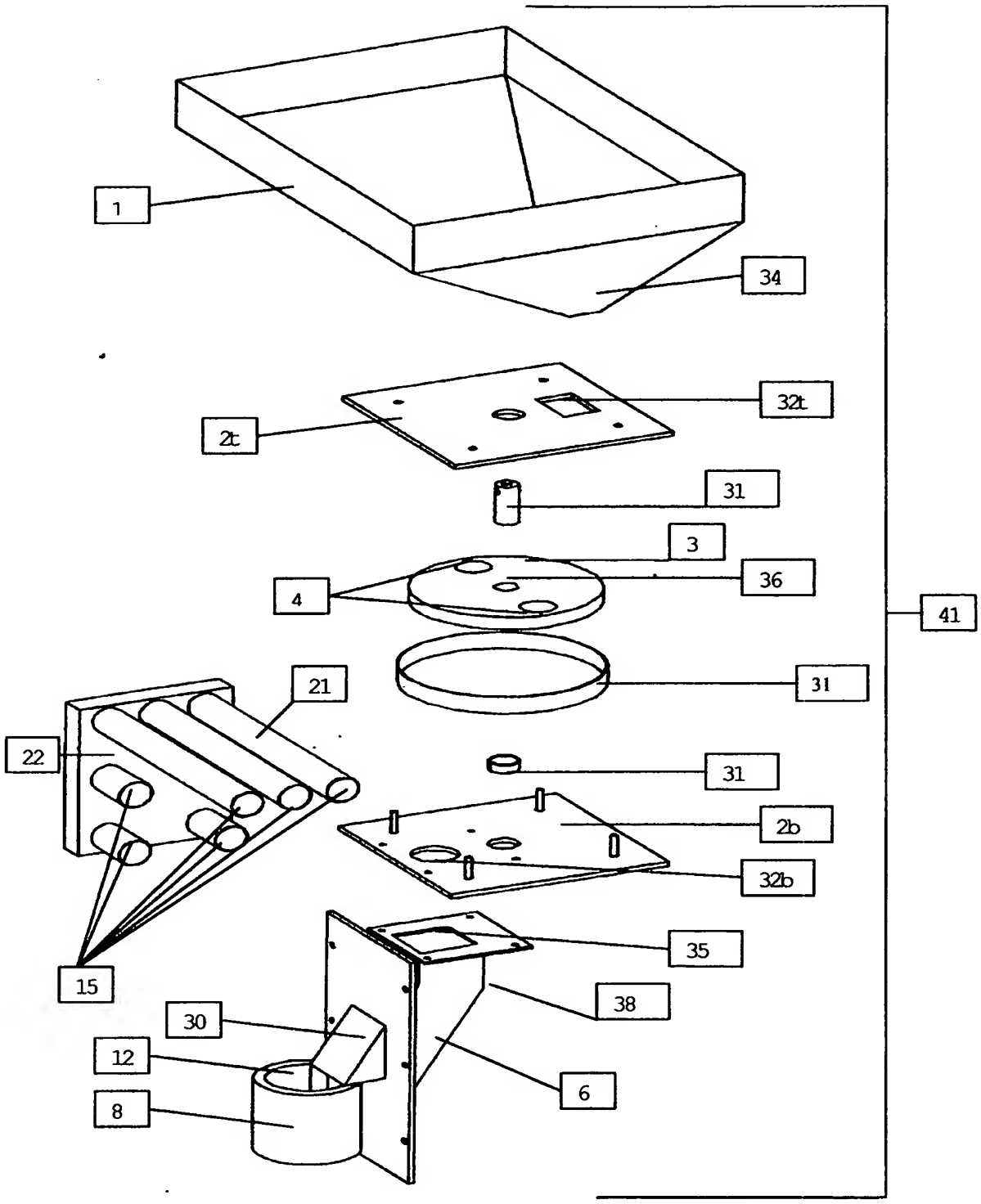

Fig. 1

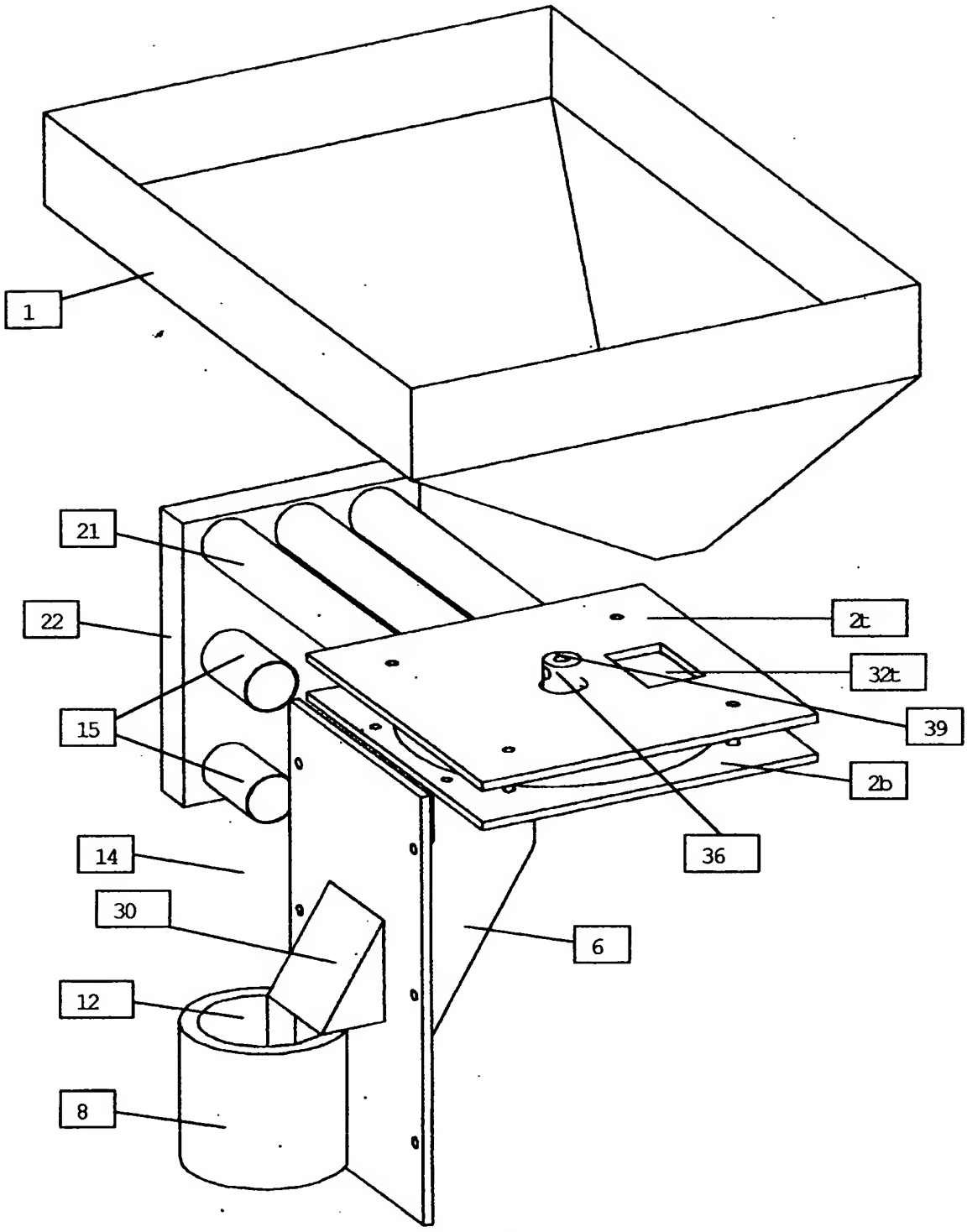

Fig. 2

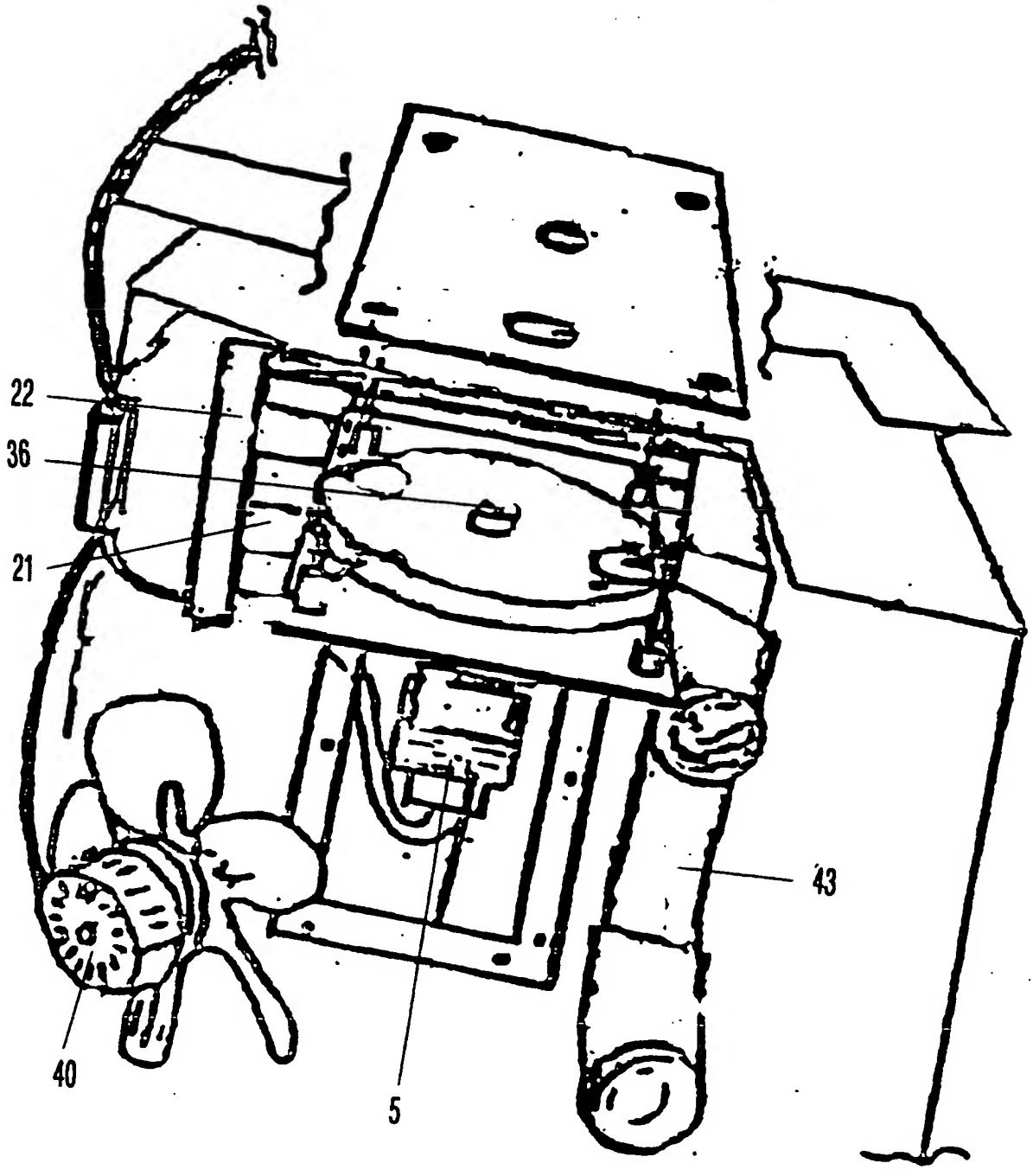

FIG. 3

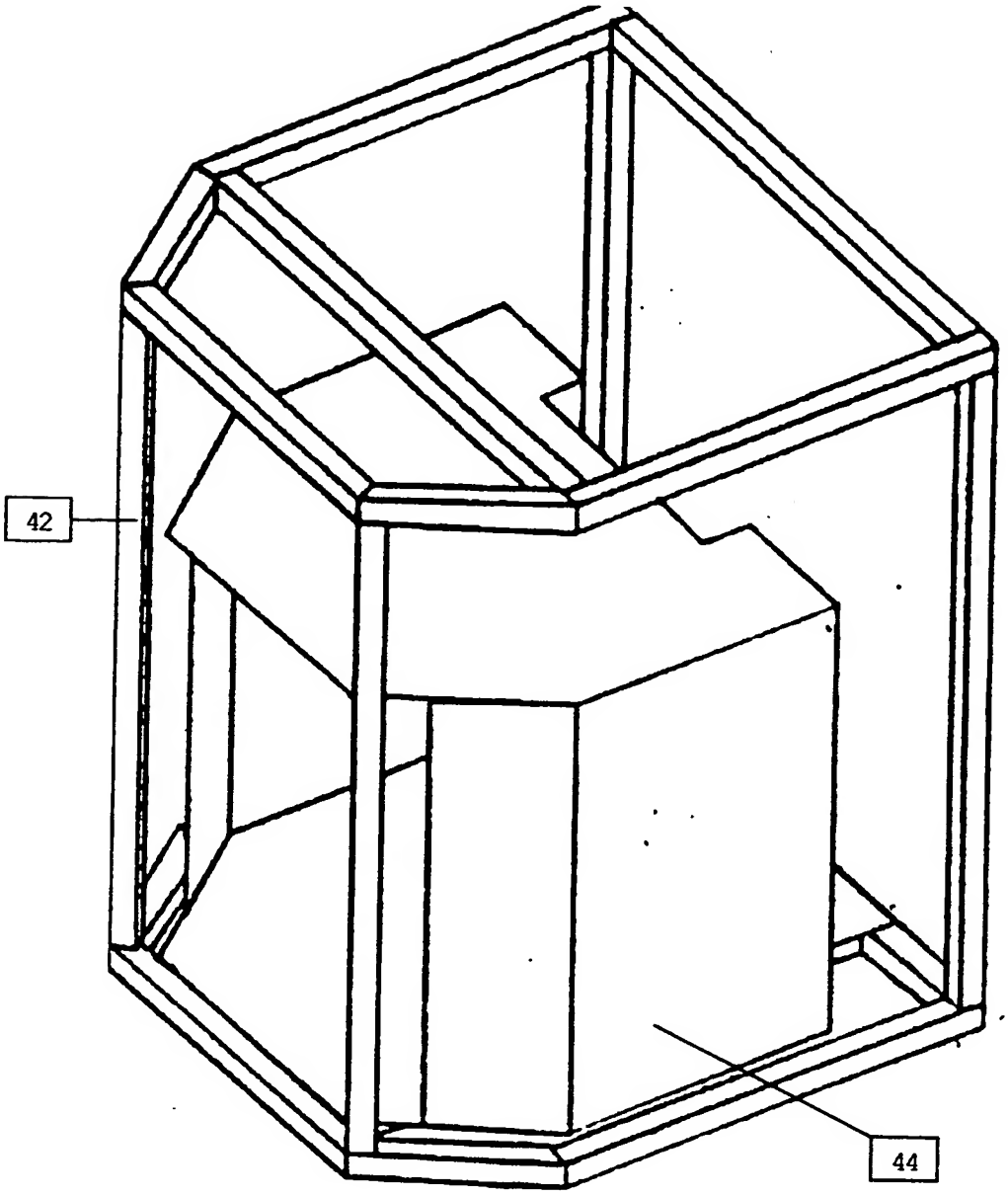

Fig. 4

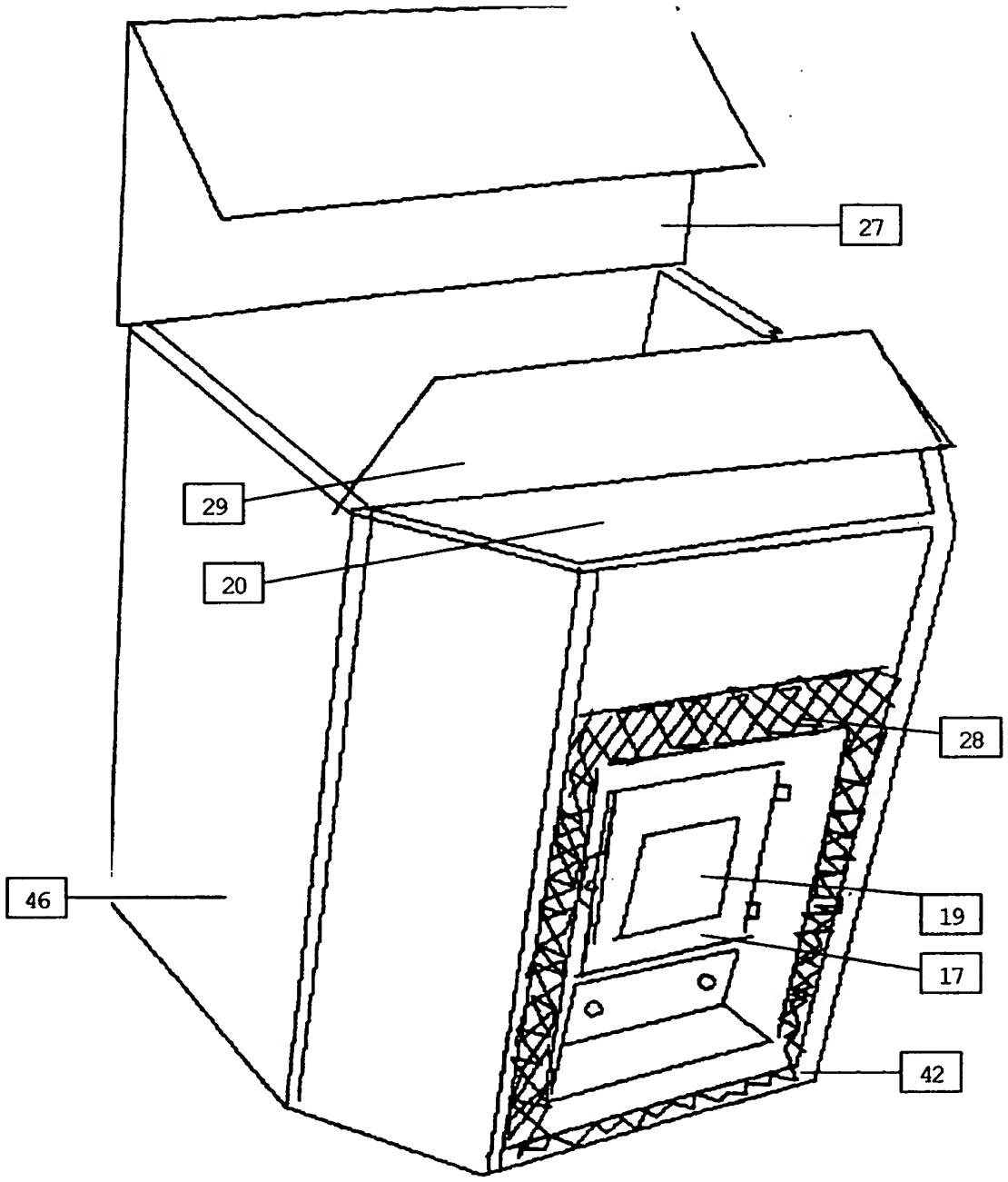

Fig. 5

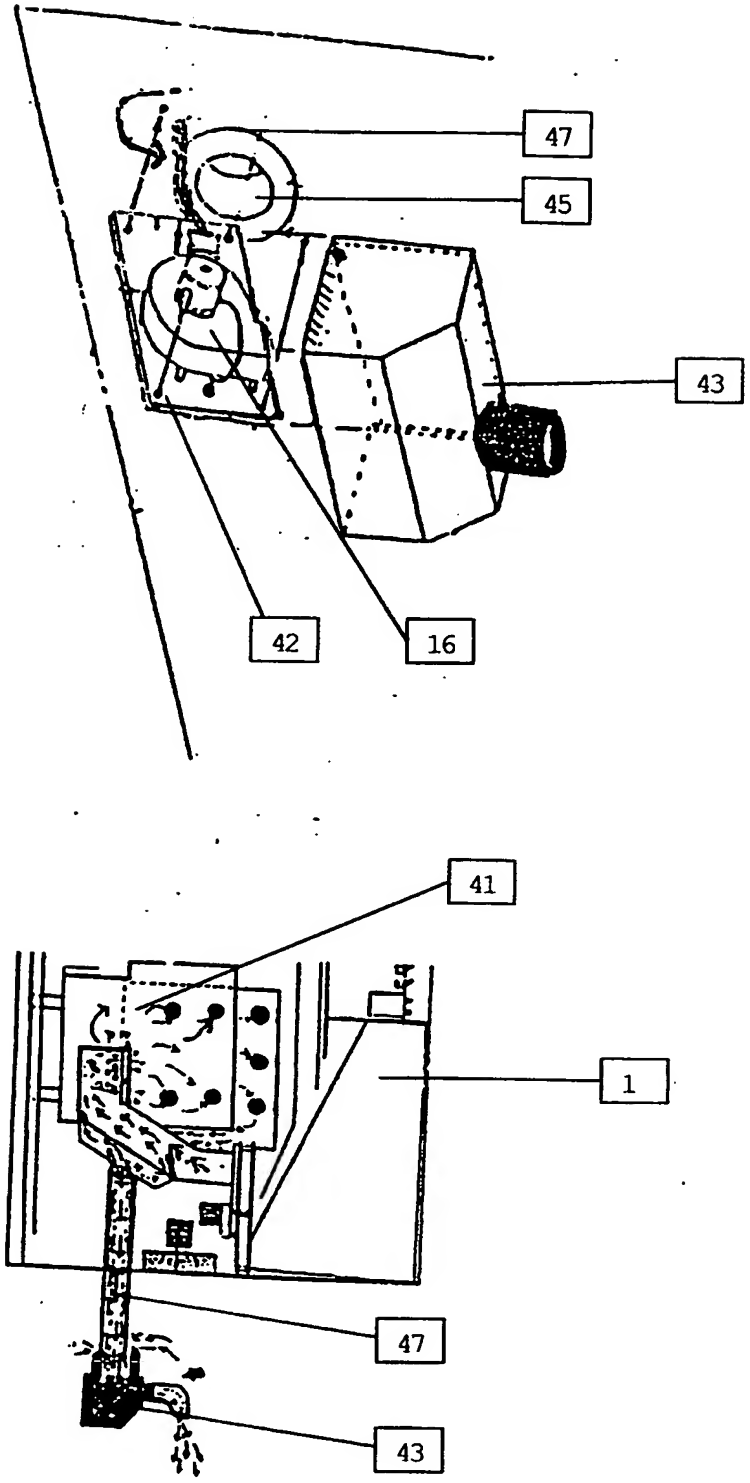

Fig. 6

Application number/ Numéro de demande : 2358404

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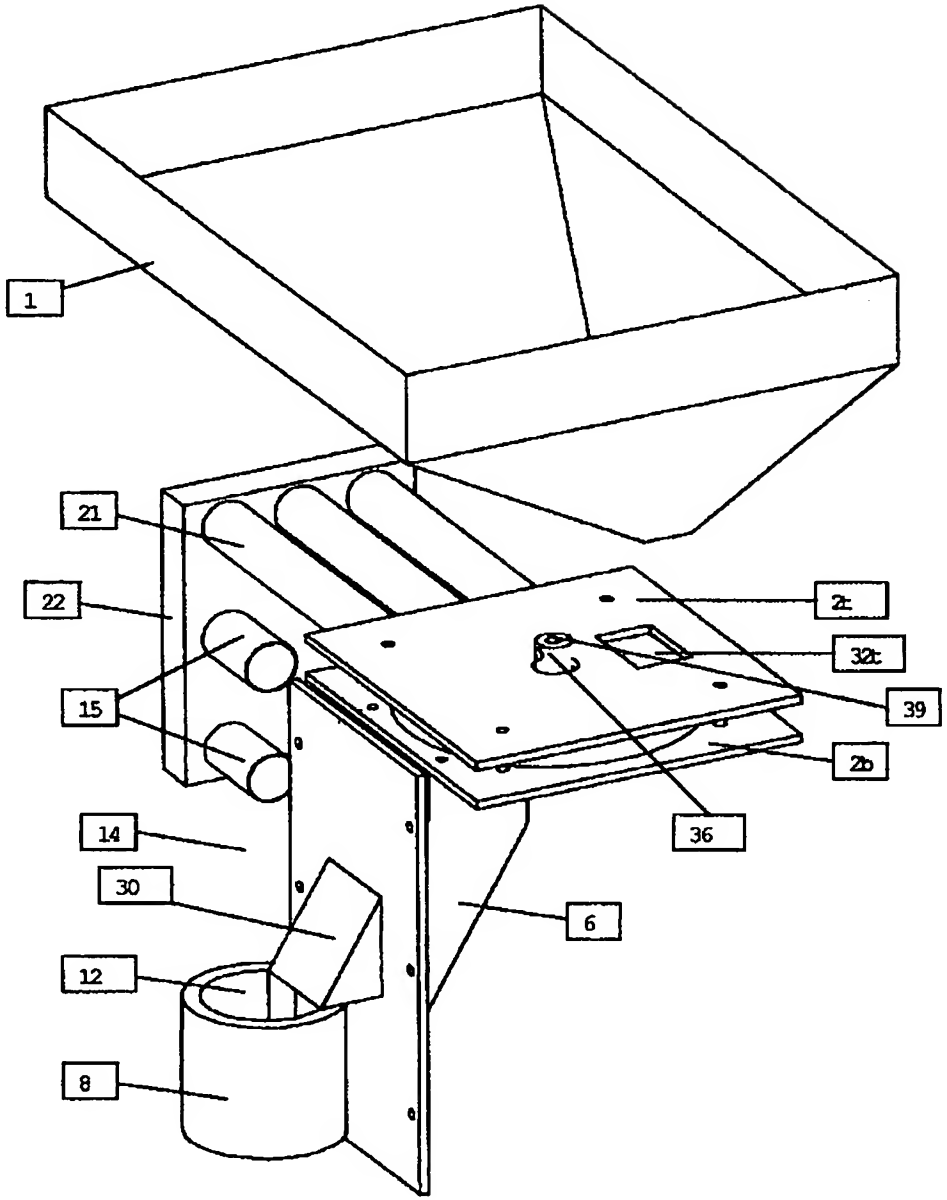
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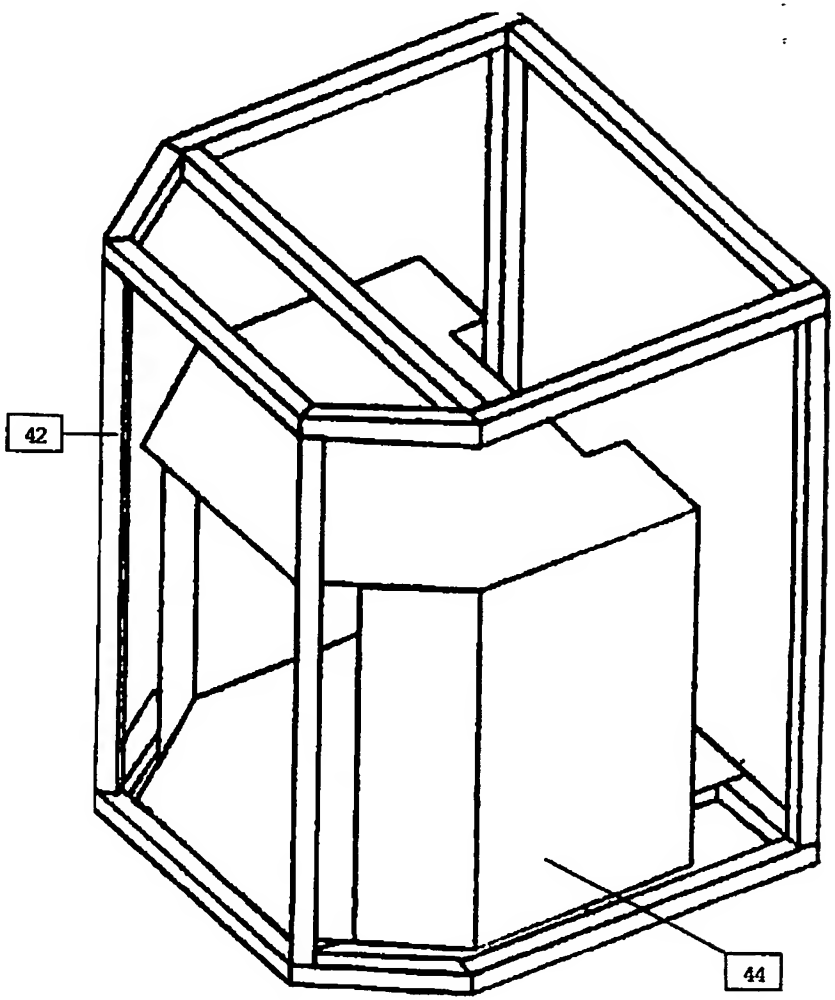
42
44